

## RESEARCH VESSEL SURVEY REPORT

**RV CEFAS ENDEAVOUR**  
**Survey: C END 3a/2023.**

### STAFF:

Name	Role	Name	Role
Louise Straker Cox	SIC	Ben Hatton	SIC
Stephen Shaw	2IC	Nicola Hampton	2IC
Mary Brown	Deckmaster	Samantha Barnett	Deckmaster
Richard Humphreys	Sampler	Tom Woods	Sampler
Ben Hersey	Sampler	Gary Thomas	Sampler
Joseph Ribiero	Genetics	Tom Gibson	Sampler
Linford Mann	Sampler	Charlie Hobbs	Sampler
Rob Kynoch (Marine Scotland)	Advisor	Joana Silva	Sampler

### DURATION:

**February 19 – March 10 2023 (20 days; 17 days at sea)**

### LOCATION:

**Western English Channel, Bristol Channel, Celtic Sea, Irish Sea (ICES div. 7e-h)**

### PRIMARY AIMS:

1. To carry out an otter trawl survey of the demersal fisheries resources in the Celtic Sea and western English Channel using a Jackson light hopper otter trawl (JTS610) in order to collect appropriate data to inform assessments of the fish stocks and fish assemblages in the area. The main aims are to collect relevant data on the:
  - a) Distribution, size composition and abundance of all fish and shellfish species caught;
  - b) Age–length distribution of commercially important fish species;
  - c) Individual length, weight, sex and maturity information for commercial fish species (in support of the EU Data Collection Group);
  - d) Distribution of macrobenthos, gelatinous zooplankton and anthropogenic debris;
  - e) Surface and bottom temperature and salinity data using CTD and oceanographic data using ESM2.
  
2. To collect multibeam data and fisheries acoustic data at three operating frequencies (38, 120 & 200 kHz) continuously throughout the survey.

## SECONDARY AIMS

3. Tag and release specimens of starry smooth-hound *Mustelus asterias*, spurdog *Squalus acanthias*, tope *Galeorhinus galeus*, common blue skate *Dipturus batis* and flapper skate *Dipturus intermedius*, blonde ray *Raja brachyura* and cuckoo ray *Leucoraja naevus*, in support of the ICES Working Group for Elasmobranch Fishes, to inform on stock units for demersal elasmobranchs (Jim Ellis – Cefas, Lowestoft).
4. To freeze any unusual fish species for subsequent identification / verification in the laboratory, including specimens of eelpout *Zoarces*, *Lycodes* and *Lycenchelys*, sea scorpions Cottidae (Subarea 4a only), and any unusual fish species, which may also be used in otolith research (Jim Ellis/Gary Burt - Cefas, Lowestoft).
5. To retain any dead specimens of tope *Galeorhinus galeus* and common skate *D. batis* and *D. intermedius* for biological studies (Jim Ellis – Cefas, Lowestoft).
6. Collect additional data from dead skates and rays (males: testes weight and outer clasper length; females: ovary weight and shell gland width) and collect a section of vertebral column comprising ca. 6-8 vertebrae from that part overlying the body cavity; samples to be kept frozen as part of Defra project C8503 to improve the methodology to assess finfish, pelagic, data-limited, and non-quota stocks. (Jim Ellis/Sophy Phillips – Cefas, Lowestoft).
7. Retain any dead specimens of shad *Alosa alosa* and *A. fallax* and lamprey *Petromyzon marinus* and *Lampetra fluviatilis* for biological studies (Teá Basic – Cefas, Lowestoft)
8. Cetacean observations will be recorded where possible and sent to the Sea Watch Foundation.
9. Collect, retain, and filter surface water samples from Ferrybox underway water supply every 12 hours (or once a day) for subsequent chlorophyll sampling from 1<sup>st</sup> March 2023, in support of SLA25 (Naomi Greenwood – Cefas, Lowestoft).
10. Collect queen scallops (queenies) *Aequipecten opercularis* to allow for experimental work on ageing, for L/W relationship analysis, development of length to height parameters and, to provide specimens to Bangor University for further work which will be made available to ICES WGScallop (Jessica Harvey – Cefas, Lowestoft)
11. Genomic sampling of selected to study population genomics as part of the Defra project C8503 to improve methodology to assess finfish, pelagic, data limited and non-quota stocks (Eva Garnacho/David Murray – Cefas, Lowestoft).
12. Retain examples of mackerel *Scomber scombrus* for sampling training on shore (Kirsty Bradley – Cefas, Lowestoft).

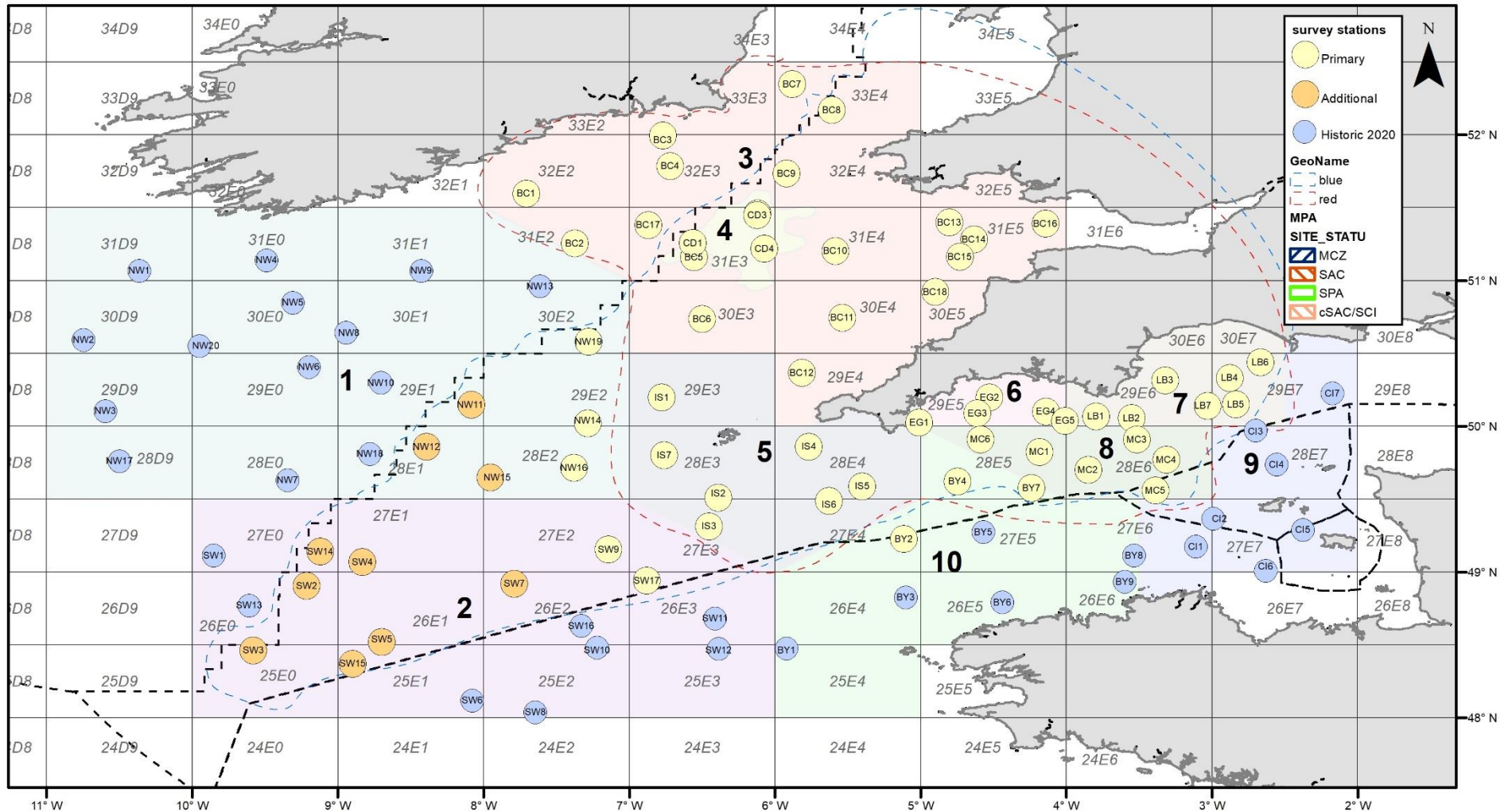


Figure 1: CEnd 3a/23 survey map

**NARRATIVE: (All times are GMT)**

The 2023 Q1 south-west otter trawl survey (from here-on referred to as CEnd 3a/23) departed Swansea on February 22, 2023 at ~08:00hr. On board RV Cefas Endeavour were 13 Cefas scientists and an advisor from Marine Scotland, Rob Kynoch, who joined the survey for the first week to help with gear rigging and performance calibration of the JTS610 light hopper trawl used by Cefas for the first time. The survey sailed three days later than planned due to unforeseen maintenance required on the single net drum.

The ship left Swansea harbour and proceeded south to station BC16 (Figure 1), where calibration of the net and equipment were completed. This took much of the day, with a shakedown tow not able to be conducted until the evening. This however, was successful with ~100 kg caught with lesser-spotted dogfish *Scyliorhinus canicula* being the most abundant component with a 48 kg catch weight. It was then discovered that the hydro-winch had suffered a fault which prevented collection of bottom salinity samples.

More adjustments to the gear delayed deployment of the net at BC13 but it was finally shot away after midnight on February 23. While the net geometrics were stable on the sensors, unfortunately several rocks were caught which caused significant damage to the belly of the net. The 146 kg catch was invalidated as a result. Four female spurdog from the catch were tagged and released as per secondary aim #3.

Mending of the net took until midday as CEnd 3a/23 moved on to BC14 and BC15. These were both completed successfully, with catches of 112 kg and 135 kg, respectively. Whiting *Merlangus merlangius* was the most abundant species at BC14 (40 kg), although many juvenile starry smooth-hounds were also caught (22 kg). Lesser-spotted dogfish (32 kg), spotted ray *Raja montagui* (28 kg) and starry smooth-hounds comprised most of the catch at BC15.

The survey then moved south-west to BC18. Gear damage had been encountered at this location in 2020, so a cautious approach was taken to trying to find a clear tow on which to deploy the trawl. Unfortunately, after a number of passes using the echosounder, the ground was deemed too rough and it was determined that there would be high risk of damaging the net. The station was therefore abandoned and CEnd 3a/23 moved back north to attempt BC13 again. On this occasion the tow was completed successfully, with a modest catch of lesser spotted dogfish (89 kg), spurdog (81 kg) and thornback ray *Raja clavata* (30 kg).

The survey then returned to Swansea to change staff via pilot boat before heading back west to station BC10 by the early afternoon of February 24. This catch was the largest of the survey so far with over 220 kg of haddock *Melanogrammus aeglefinus*, 113 kg grey gurnard *Eutrigula gurnardus* and 103 kg of lesser-spotted dogfish. Further west at the Celtic Deep, station CD4 was completed. This was another station where the lesser-spotted dogfish was most abundant, with 122 kg caught here, along with smaller quantities of pilchard *Sardina pilchardus* (29 kg) and juvenile horse mackerel *Trachurus trachurus* (19 kg).

CD2 and CD3 were then completed with reduced tow length of ~1 nm due to their close proximity to each other (only 0.6 nm apart), with CD2 catch comprising lesser-spotted dogfish,

blue whiting *Micromeistius poutassou* and haddock (~25 kg each), and CD3 yielding slightly more haddock and lesser-spotted dogfish (~30 kg), but with a similar amount of pilchard too. The survey then moved northeast to BC9 and sampled a larger catch of haddock (299 kg) and whiting (174 kg) and on to BC8, where another catch abundant in elasmobranchs saw starry smooth-hounds (237 kg) and lesser-spotted dogfish (67 kg) recorded.

By midday on February 25, CEnd 3a/23 had moved into south-east Irish waters at BC7. This tow had to be repeated after the first attempt was abandoned early due to unstable net geometric readings, but a successful catch was brought on board at the second attempt, with lesser-spotted dogfish and starry smooth-hounds (78 kg and 65 kg, respectively), recorded with 39 kg of whiting. Further west, at BC3, a large female tope (103 cm, 4.255kg, Figure 2) was tagged and released. The catch was abundant in dab *Limanda limanda* (119 kg) and grey gurnard (99 kg).



**Figure 2:** Female tope *Galeorhinus galeus* (103 cm, 4.255kg) caught at BC3

Just to the south, at BC4, the largest catch of the survey so far was brought aboard, ~1.5 t; with 413 kg of Norway pout *Trisopterus esmarkii*, 375 kg of dab, and ~225 kg each of whiting and haddock comprising most of the catch. The survey then moved west to BC1 and BC2, which were abundant in haddock (191 kg and 170 kg, respectively), before heading back east to BC17. Here, haddock was lower in catch weight at 52 kg, with lesser-spotted dogfish being the most abundant at 110 kg. Of note was a juvenile red band fish *Cepola rubescens* (18 cm, 0.007 kg, Figure 3).



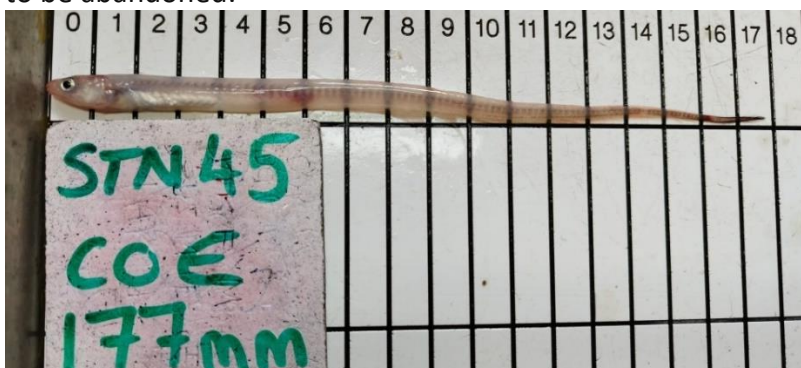
**Figure 3:** juvenile red band fish *Cepola rubescens* (18 cm, 0.007 kg) caught at BC17

Unfortunately, upon retrieving the trawl at BC17 an issue with the net drum became apparent and, after examination it was decided to transit to Falmouth for repairs. Over the following days RV Cefas Endeavour remained either in port or close to it, for repairs and testing until the survey resumed again at 1500hr, March 4. The testing was concluded with a full trawl at EG1, which was successful and recorded a catch abundant in pelagic species such as sprat *Sprattus sprattus* (419 kg), pilchard (200 kg) and horse mackerel (157 kg).

Over the next 24 hours, IS5 and IS6 were completed, with catches abundant in poor cod *Trisopterus minutus* (173 kg) and horse mackerel (180 kg), respectively, before a larger catch of horse mackerel (~1 t) and pilchard (~150 kg) was brought aboard at IS4. CEnd 3a/23 then moved north to BC12 and completed a 2 nm tow, but unfortunately rocks caught in the net ripped the belly and caused significant gear damage. The repairs took around three hours before BC12 could be surveyed again, this time successfully with a small catch of spurdog (100 kg), grey gurnard (61 kg) and haddock (50 kg).

The survey then moved back to the Celtic Deeps to the north-west, where the catch at CD1 was abundant in juvenile spurdog. Nearly 800 kg were recorded here, with most between 21-67 cm. With BC5 close-by, the decision was taken to only complete a 1 nm tow. Over 200 kg of spurdog were also caught here, with many juveniles recorded again. Lesser-spotted dogfish (118 kg) and haddock (145 kg) were also abundant in this catch.

Stations BC6, NW19 and IS1 were all small catches (<100 kg each) abundant in haddock, blue whiting, lesser-spotted dogfish, herring *Clupea harengus*, boar fish *Apros caper* and lemon sole *Microstomus kitt*. Of note, at NW19 was the first record of a juvenile conger eel *Conger conger* in its post-larval stage on this survey. Examples would also be seen on following stations (Figure 4). Unfortunately, it was not possible to find clear ground to fish at IS7 and so this had to be abandoned.



**Figure 4:** an example of a juvenile conger eel caught at NW16 (17cm, 0.003kg)

Further west at NW14 on March 7, John Dory *Zeus faber* was the most abundant species by catch weight at 58 kg, along with 38 kg of spurdog and 28 kg of Norwegian lobster *Nephrops norvegicus*. Spurdog were also present at the following stations NW16 and NW15, with 70 kg and 140 kg caught respectively. Blue whiting, however, was the most abundant in catch weight at NW15 with 580 kg recorded. Both stations also saw blue skate and flapper skate caught here, with four male flapper skates (68-120 cm), six male blue skates (52 - 123 cm) and two female blue skate (104 cm and 121 cm). All were assessed and then released (Figure 5), but only one was lively enough to be tagged with Petersen discs.



**Figure 5:** examples of female blue *Dipturus batis* (left) and male flapper *D. intermedius* skate caught at NW16

NW11 and NW12, further west, both saw small catches (<150 kg each) abundant in spurdog and blue whiting but unfortunately, once this tow was completed the weather had deteriorated to the point that no more fishing would be possible and continued poor weather was forecast until the end of the survey. RV Cefas Endeavour travelled east to Falmouth, docking at approximately 1400hr on March 10 2023.

#### **RESULTS BY AIM:**

1. *To carry out an otter trawl survey of the demersal fisheries resources in the Celtic Sea and western English Channel using a Jackson light hopper otter trawl (JTS610).*

The JTS610 light hopper trawl was selected for the survey as it provided an opportunity to test the approved future IBTS (International Bottom Trawl Surveys) replacement design net for the GOV (Grande Overture Verticalé). The JTS610 replaced the BT195 “monk trawl” used on previous south-west otter trawl surveys in 2018-2020. As can be seen in table 1, the JTS610 is a smaller otter trawl but does have a 20 mm cod-end liner to retain smaller species. Given it was expected that the gear may collect a greater representation of fish community assemblages, the minimum tow distance for the survey series was reduced from 1.5 nm to 1 nm, with 2 nm still the target tow distance. **The difference in catchability between the nets should be borne in mind when catch weights and species composition are compared between this and previous surveys in the series.**

**Table 1:** differences in the JTS610 and BT195 trawls used in the survey series

Specification	JTS610	BT195
Headline length (m)	46	52
Fishing line length (m)	25	47
Herding mesh (wings) size (mm)	200	160
Cod-end mesh size (mm)	70	50
Cod-end liner	Yes, 20 mm	No
Ground gear hopper discs	Busom: 12.2 m x 300 mm discs Bunts: 12.2 m x 250 mm discs	Busom: 46m x 400 mm discs
Upper bridles	50 m x 16 mm	37 m x 18 mm
Lower bridles	50 m x 24 mm	37 m x 19 mm mid-link chain
Sweeps	68 m x 26 mm	73 m x 26 mm

As can be seen in Table 2, a total of 30 valid fishing tows were completed during the course of the survey. There were three invalid tows (two resulting in gear damage, one with below minimum distance covered), all of which were repeated successfully. The two “additional” tows were recorded after lower-than-expected headline sensor readings were observed but these were not repeated due to time constraints. Net geometrics for the JTS610 can be found in Appendix I, while a summary of stations completed can be found in Appendix II.

**Table 2:** Gear deployments on CEnd 3a/23 survey

Gear	Valid	Invalid	Additional	Total
JTS610 light hopper trawl	30	3	2	35
ESM2 profiler with Niskin water sampler <sup>1</sup>	12	0	0	12
Surface water samples <sup>2</sup>	3	0	0	3

<sup>1</sup>includes sound velocity profile casts for multibeam calibration

<sup>2</sup>taken while hydro winch was unavailable for bottom salinity sampling

- a) Distribution, size composition and abundance of all fish and shellfish species caught;
- b) Age–length distribution of commercially important fish species;
- c) Individual length, weight, sex and maturity information for commercial fish species...;

Table 3 comprises all fish, shellfish and cephalopod species caught on the survey in descending order by catch weight. Distribution maps for the top ten species can be found in Figures 6a-6j, while length distributions for the same species can be found in Figures 7a-7j. Table 4 details the number of otoliths and additional biological parameters collected on the survey.



**Table 3:** Fish, shellfish and cephalopod species caught on the survey, ranked by catch weight

Common species name	Scientific species name	Cefas species code	Total catch weight (kg)
Haddock	<i>Melanogrammus aeglefinus</i>	HAD	1880.775
Spurdog	<i>Squalus acanthias</i>	DGS	1678.831
Horse mackerel	<i>Trachurus trachurus</i>	HOM	1632.448
Lesser-spotted dogfish	<i>Scyliorhinus canicula</i>	LSD	1395.614
Blue whiting	<i>Micromesistius poutassou</i>	WHB	1147.625
Whiting	<i>Merlangius merlangus</i>	WHG	663.724
Dab	<i>Limanda limanda</i>	DAB	590.753
Starry smooth-hound	<i>Mustelus asterias</i>	SDS	551.243
Sprat	<i>Sprattus sprattus</i>	SPR	524.229
Grey gurnard	<i>Eutrigla gurnardus</i>	GUG	523.652
Poor cod	<i>Trisopterus minutus</i>	POD	517.325
Norway pout	<i>Trisopterus esmarki</i>	NOP	479.596
Pilchard (sardine)	<i>Sardina pilchardus</i>	PIL	444.671
European hake	<i>Merluccius merluccius</i>	HKE	327.388
European mackerel	<i>Scomber scombrus</i>	MAC	225.369
Spotted ray	<i>Raja montagui</i>	SDR	190.21
European anchovy	<i>Engraulis encrasicolus</i>	ANE	143.917
Norway lobster	<i>Nephrops norvegicus</i>	NEP	125.147
Thornback ray	<i>Raja clavata</i>	THR	110.225
John Dory	<i>Zeus faber</i>	JOD	106.402
European plaice	<i>Pleuronectes platessa</i>	PLE	106.046
Herring	<i>Clupea harengus</i>	HER	102.679
Blue skate	<i>Dipturus batis</i>	SKG	93.283
Barrel jellyfish	<i>Rhizostoma octopus</i>	BAR	90.244
Lemon sole	<i>Microstomus kitt</i>	LEM	64.23
Megrim	<i>Lepidorhombus whiffiagonis</i>	MEG	53.487
Tope shark	<i>Galeorhinus galeus</i>	GAG	54.371
Anglerfish (monkfish)	<i>Lophius piscatorius</i>	MON	46.868
Blonde ray	<i>Raja brachyura</i>	BLR	41.365
Greater-spotted dogfish	<i>Scyliorhinus stellaris</i>	DGN	39.299
Common dragonet	<i>Callionymus lyra</i>	CDT	35.468
Boar fish	<i>Capros aper</i>	BOF	35.384
Flapper skate	<i>Dipturus intermedius</i>	SKF	34.34
Thick-back sole	<i>Microchirus variegatus</i>	TBS	32.576
Red gurnard	<i>Chelidonichthys cuculus</i>	GUR	31.934
European conger eel	<i>Conger conger</i>	COE	30.029
Small-eyed ray	<i>Raja microocellata</i>	PTR	22.905
Long-rough dab	<i>Hippoglossoides platessoides</i>	PLA	20.927
Dover sole	<i>Solea solea</i>	SOL	19.696



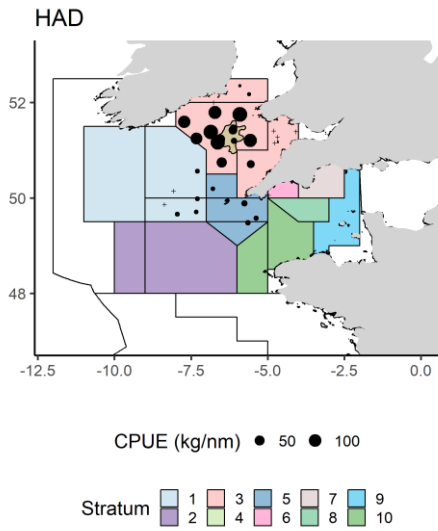
Atlantic cod	<i>Gadus morhua</i>	COD	16.527
Tub gurnard	<i>Chelidonichthys lucerna</i>	TUB	14.984
Greater spider crab	<i>Maja brachydactyla</i>	SCR	13.305
European seabass	<i>Dicentrarchus labrax</i>	ESB	12.087
Greater forkbeard	<i>Phycis blennoides</i>	GFB	11.237
Black-bellied anglerfish	<i>Lophius budegassa</i>	WAF	10.997
Queen scallop	<i>Aequipecten opercularis</i>	QSC	9.495
Common ling	<i>Molva molva</i>	LIN	8.857
Whiting-pout (bib)	<i>Trisopterus luscus</i>	BIB	8.253
Pollack	<i>Pollachius pollachius</i>	POL	7.965
Striped red mullet	<i>Mullus surmuletus</i>	MUR	7.458
Argentine	<i>Argentina spp.</i>	ARG	6.845
Cuckoo ray	<i>Leucoraja naevus</i>	CUR	5.9
Immaculate sandeel	<i>Hyperoplus immaculatus</i>	ISE	5.559
Curled Octopus	<i>Eledone cirrhosa</i>	EDC	4.045
Greater weever-fish	<i>Trachinus draco</i>	WEG	4.013
Witch	<i>Glyptocephalus cynoglossus</i>	WIT	2.585
Imperial scaldfish	<i>Arnoglossus imperialis</i>	ISF	2.516
Shagreen ray	<i>Leucoraja fullonica</i>	SHR	2.515
Common cuttlefish	<i>Sepia officinalis</i>	CTC	2.276
European squid	<i>Loligo vulgaris</i>	LLV	2.05
European common squid	<i>Alloteuthis subulata</i>	ATS	1.831
Three-bearded rockling	<i>Gaidropsarus vulgaris</i>	TBR	1.354
European lobster	<i>Homarus gammarus</i>	LBE	1.015
Brill	<i>Scophthalmus rhombus</i>	BLL	0.882
Northern squid	<i>Loligo forbesii</i>	NSQ	0.878
Lesser flying squid	<i>Todaropsis eblanae</i>	OME	0.773
Common spiny lobster	<i>Palinurus elephas</i>	SLO	0.745
Spotted dragonet	<i>Callionymus maculatus</i>	SDT	0.643
Great scallop	<i>Pecten maximus</i>	SCE	0.293
Atlantic bobtail squid	<i>Sepiolla atlantica</i>	SPY	0.258
Scaldfish	<i>Arnoglossus laterna</i>	SDF	0.254
Four-bearded rockling	<i>Enchelyopus cimbrius</i>	FRR	0.248
Twaite shad	<i>Alosa fallax</i>	TAS	0.204
Lesser weever fish	<i>Echiichthys vipera</i>	WEL	0.202
Stout bobtail squid	<i>Rossia macrosoma</i>	ROM	0.185
Greater sandeel	<i>Hyperoplus lanceolatus</i>	GSE	0.175
Broadtail shortfin squid	<i>Illex coindettii</i>	SQI	0.171
Sand sole	<i>Pegusa lascaris</i>	SOS	0.166
Goldsinny wrasse	<i>Ctenolabrus rupestris</i>	GDY	0.15
Pink cuttlefish	<i>Sepia orbignyana</i>	SEO	0.131



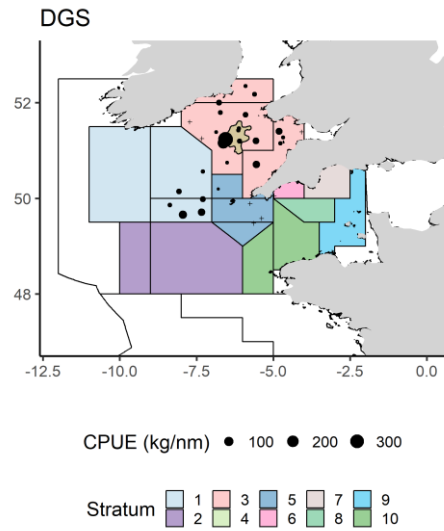
Common sandeel	<i>Ammodytes tobianus</i>	TSE	0.101
Common seasnail	<i>Liparis liparis</i>	SSL	0.081
Solenette	<i>Buglossidium luteum</i>	SOT	0.079
Ekstrom's topknot	<i>Zeugopterus regius</i>	EKT	0.065
Butterfly blenny	<i>Blennius ocellaris</i>	BBY	0.058
Velvet swimming crab	<i>Necora puber</i>	MLP	0.047
Blue jellyfish	<i>Cyanea lamarckii</i>	BLU	0.032
Unidentified sandeel	<i>Ammodytes spp.</i>	SAX	0.028
Black seabream	<i>Spondylisoma cantharus</i>	BKS	0.021
Elegant cuttlefish	<i>Sepia elegans</i>	SEE	0.019
Northern rockling	<i>Ciliata septentrionalis</i>	NNR	0.017
Pogge (armed bullhead)	<i>Agonus cataphractus</i>	POG	0.013
Silvery pout	<i>Gadiculus argenteus</i>	SYP	0.008
Red band fish	<i>Cepola rubescans</i>	RPF	0.007
Five-bearded rockling	<i>Ciliata mustela</i>	FVR	0.006
Sand goby	<i>Pomatoschistus spp.</i>	POM	0.006
Norwegian topknot	<i>Phrynorhombus norvegicus</i>	NKT	0.003
Tadpole fish	<i>Raniceps raninus</i>	LFB	0.003
Pearlside	<i>Maurolicus mulleri</i>	PLS	0.002
Jeffery's goby	<i>Buenia jeffersii</i>	JYG	0.001
Reticulated dragonet	<i>Callionymus reticulatus</i>	RDT	0.001
Transparent goby	<i>Aphia minuta</i>	TPG	0.001

**Table 4:** Number of biological samples collected ranked by descending number for otolithed species, and then non-otolithed species

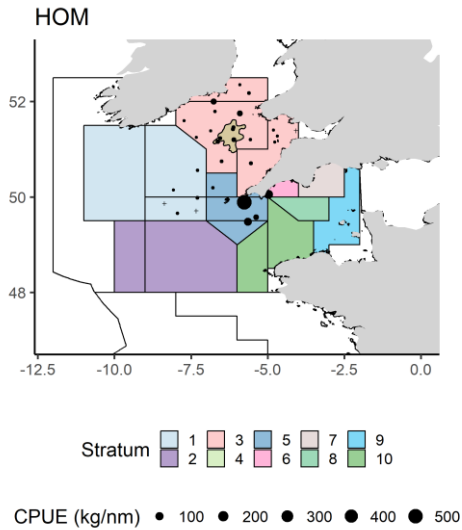
Common species name	Scientific species name	Cefas species code	Number of otoliths
Whiting	<i>Merlangius merlangus</i>	WHG	687
Haddock	<i>Melanogrammus aeglefinus</i>	HAD	679
European hake	<i>Merluccius merluccius</i>	HKE	530
Megrim	<i>Lepidorhombus whiffiagonis</i>	MEG	286
European plaice	<i>Pleuronectes platessa</i>	PLE	239
Herring	<i>Clupea harengus</i>	HER	192
Lemon sole	<i>Microstomus kitt</i>	LEM	171
Sprat	<i>Sprattus sprattus</i>	SPR	158
Dover sole	<i>Solea solea</i>	SOL	87
European mackerel	<i>Scomber scombrus</i>	MAC	75
Pilchard (sardine)	<i>Sardina pilchardus</i>	PIL	65
Anglerfish (monkfish)	<i>Lophius piscatorius</i>	MON	58
European anchovy	<i>Engraulis encrasicolus</i>	ANE	37
Tub gurnard	<i>Chelidonichthys lucerna</i>	TUB	37
Striped red mullet	<i>Mullus surmuletus</i>	MUR	35
European seabass	<i>Dicentrarchus labrax</i>	ESB	15
Black-bellied anglerfish	<i>Lophius budegassa</i>	WAF	15
Witch	<i>Glyptocephalus cynoglossus</i>	WIT	15
Atlantic cod	<i>Gadus morhua</i>	COD	7
Goldsinny wrasse	<i>Ctenolabrus rupestris</i>	GDY	5
Common ling	<i>Molva molva</i>	LIN	4
Pollack	<i>Pollachius pollachius</i>	POL	2
Black seabream	<i>Spondyliosoma cantharus</i>	BKS	1
Brill	<i>Scophthalmus rhombus</i>	BLL	1
			<b>Number of biological samples</b>
Spurdog	<i>Squalus acanthias</i>	DGS	868
Starry smooth-hound	<i>Mustelus asterias</i>	SDS	497
Spotted ray	<i>Raja montagui</i>	SDR	452
John Dory	<i>Zeus faber</i>	JOD	139
Thornback ray	<i>Raja clavata</i>	THR	80
Blonde ray	<i>Raja brachyura</i>	BLR	39
European conger eel	<i>Conger conger</i>	COE	36
Tope shark	<i>Galeorhinus galeus</i>	GAG	19
Greater-spotted dogfish	<i>Scyliorhinus stellaris</i>	DGN	19
Blue skate	<i>Dipturus batis</i>	SKG	17
Small-eyed ray	<i>Raja microocellata</i>	PTR	13
Common cuttlefish	<i>Sepia officinalis</i>	CTC	6
Flapper skate	<i>Dipturus intermedius</i>	SKF	5
Shagreen ray	<i>Leucoraja fullonica</i>	SHR	1



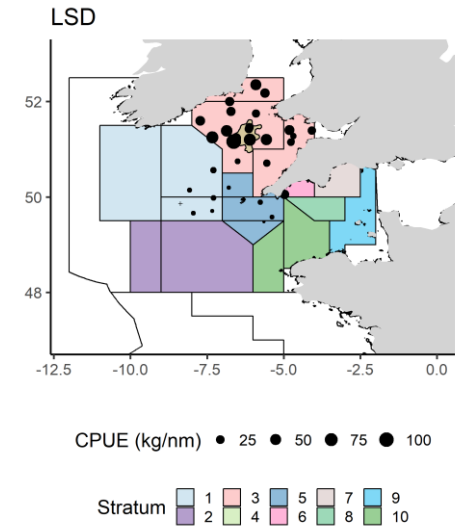
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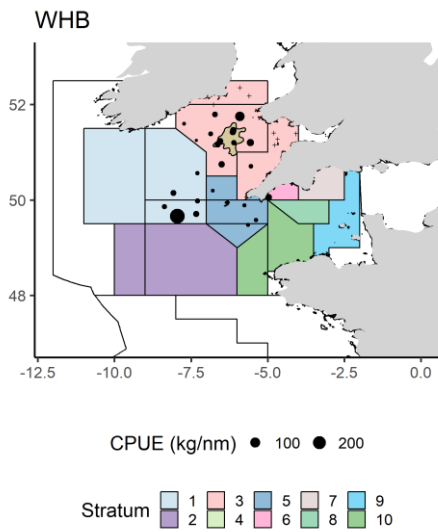
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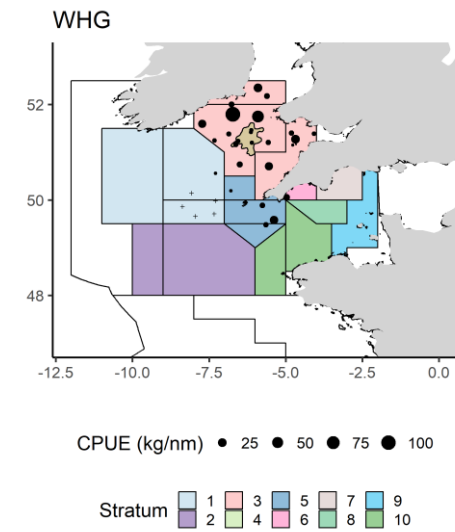
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d)

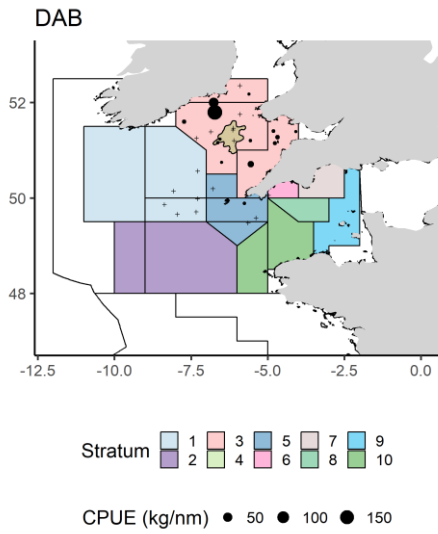


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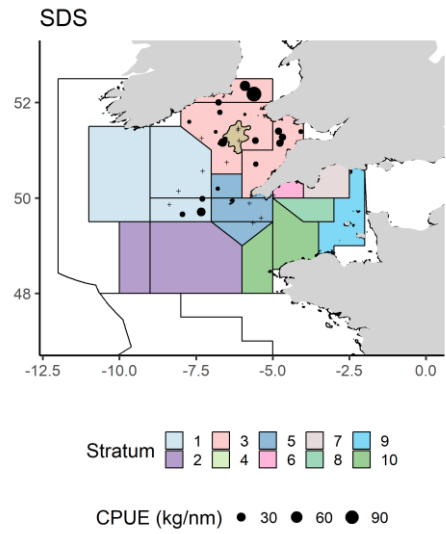


f)

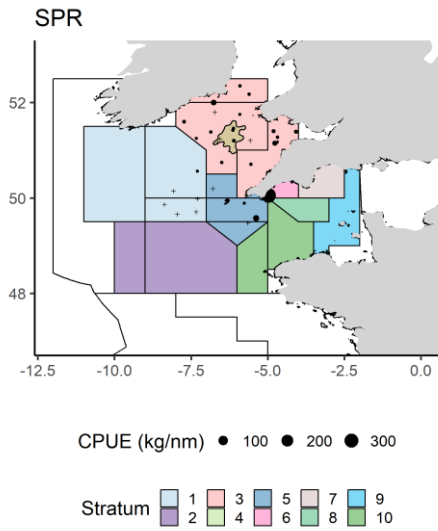
Figure 6: Catch distribution of a) haddock, b) spurdog, c) horse mackerel, d) lesser-spotted dogfish, e) blue whiting and f) whiting



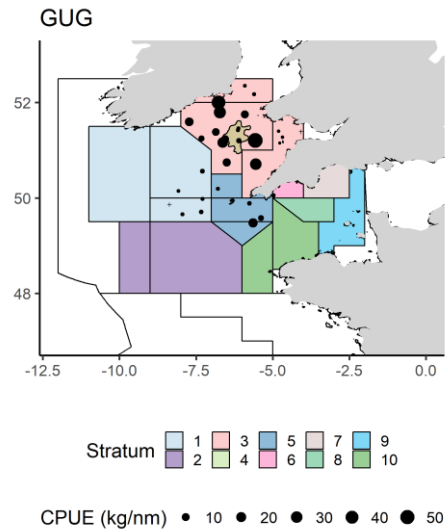
g)



h)

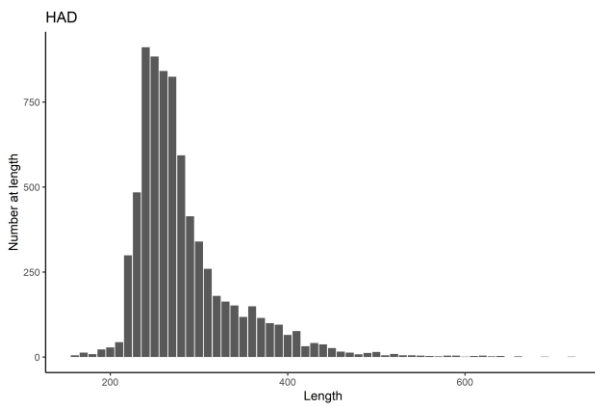


i)



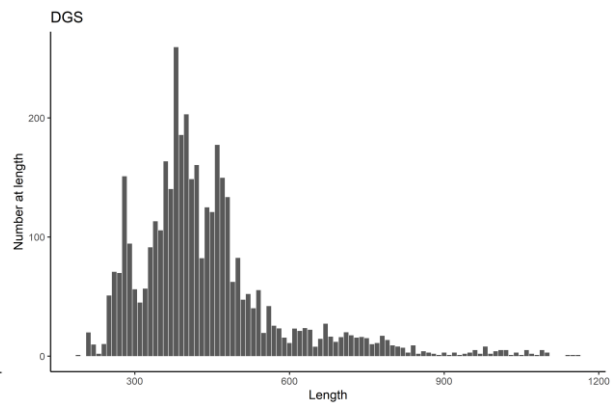
j)

**Figure 6 continued:** Catch distribution of g) dab, h) starry smooth-hound, i) sprat and j) grey gurnard.

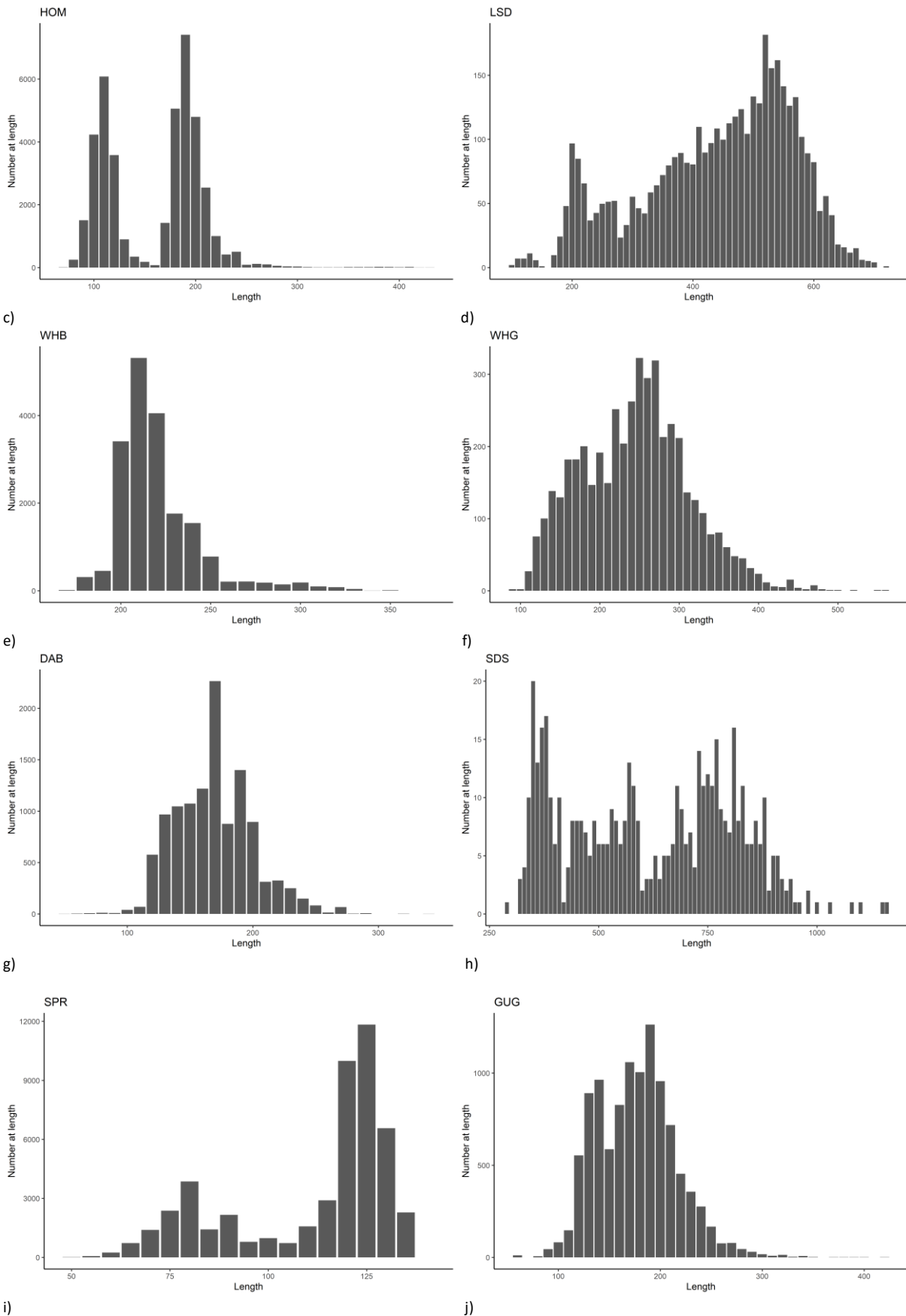


a)

**Figure 7:** Length distributions of a) haddock, b) spurdog



b)



**Figure 7 continued:** Length distributions of c) horse mackerel, d) lesser-spotted dogfish, e) blue whiting, f) whiting, g) dab and h) starry smooth hound, i) sprat and j) grey gurnard.

## Gadiformes

Haddock was the most abundant species caught on the survey by catch weight with 1880 kg recorded across the 30 valid stations completed (Table 3). This is similar to that seen in the last south-west otter trawl survey in 2020 (1987 kg), although at nearly half the effort (57 station completed in 2020). As can be seen in figure 6a, haddock was mostly distributed around the Celtic Deep (Stratums 3&4) and comprised mainly of individuals from one year-class, between 20-30 cm (figure 7a). This is very similar to the geographic and length distribution seen in 2020.

Whiting were recorded with a higher catch weight (663 kg) than that seen in 2020 (505 kg). Where in 2020 larger catches of whiting was found to be north of Cornwall, in 2023 the most abundant whiting catches were found to be further north towards the southern Irish sea (Figure 6f). Whiting caught in 2023 covered a large length distribution (9-56 cm), although those recorded in 2020 were slightly larger (up to 60 cm and mean average at 30 cm, compared to 25 cm in 2023), this is to be expected with a net designed to retain smaller-sized fish. Despite a lower total catch weight, the larger length distribution of whiting resulted in a slightly higher number of otoliths collected compared to haddock (687, to 679, respectively, Table 4).

Other gadoid species of note was blue whiting, which was the fifth highest ranked species by catch weight with 1161 kg, with the largest catches recorded in stratum 1 (figure 6e). Hake *Merluccius merluccius* was caught in similar amounts to that seen in 2020 (327 kg in 2023, compared to 317 kg in 2020) but the large length distribution meant the third largest number of otoliths were collected from hake. Only seven cod *Gadus morhua* were caught on the survey, with over 10 kg of the 16.5 kg recorded attributed to one female at 105 cm caught at BC2.

## Pleuronectiformes

Only small amounts of plaice *Pleuronectes platessa* and sole *Solea solea* were caught on the survey (106 kg and 19.6 kg, respectively). While plaice catch weight is similar to that seen in the last survey (100 kg in 2020), in approximately half the number of tows, sole catch weight was reduced as would be expected (19.6 kg in 30 tows, compared to 42 kg in 57 tows in 2020).

Dab was one of the top ten species by catch weight on the survey. The 590 kg recorded in the 30 tows in 2023, is much higher than the 42 kg caught in 57 tows in 2020. Of note, is that the most abundant dab catch was recorded at BC4, south of Ireland (373 kg, Figure 6g), which makes up 63% of the total dab weight caught in the survey.

## Pelagic fish

Horse mackerel were the third highest species recorded on the survey by catch weight (1632 kg). The largest catches were in stratum 5 (figure 6c), with almost two-thirds of the total survey catch weight found at IS4 (~1 tonne). Only 136 kg of horse mackerel was caught in 2020, but



there was reduced sampling in this area that year, and the highly mobile nature of the species could also explain the difference between surveys. The length distribution (figure 7c) shows two distinct year classes between 8-14 cm and 17-24 cm.

The 20 mm cod-end liner in the JTS610 trawl allowed greater retention of the smaller pelagic fish, this is compared to no sprat being recorded in 2020 using the BT195. As a result, sprat was ranked 9<sup>th</sup> in terms of largest catch weight on the survey, with 524 kg recorded. However, it is worth noting that 419 kg of this weight was caught at EG1 (Figure 6i), along with 45% of the total survey catch weight for pilchard. As can be seen in figure 7i, the sprat measured constitute two age classes, with over twice as many fish in the larger cohort (11.0-13.5 cm).

Pilchard and mackerel would have had comparatively similar catch weights if not for those sampled at EG1, with 444 kg and 225 kg recorded respectively, although the greater length range of the mackerel meant more otoliths were collected (75, compared to 65 for pilchard). Herring however, had 192 otoliths from a smaller total catch weight of 102 kg, but were sampled at a higher rate in half-centimetre groupings.

### **Elasmobranchs**

As with the previous surveys in 2018-2020, elasmobranch species were some of the most abundant seen in 2023 despite using a different fishing gear. Spurdog was the most abundant elasmobranch by catch weight and ranked 2<sup>nd</sup> in total on the survey, with 1678 kg caught. This is compared to 920 kg caught in 2020, but as in 2020 some of the largest recordings of spurdog were in or around stratum 4 (figure 6b). The length distribution of spurdog caught on the survey (figure 7b) shows a majority of individuals caught were under 60 cm, compared to 2020. A total of 89% (n = 3462 out of 3896) of all spurdogs caught were in this size range, compared to only 23% in 2020 (n = 99 out of 436). It is worth noting that of the 3896 individuals caught on the survey, 3212 (82%) were under 60 cm and caught at CD1 and subsequently, on BC5 on March 6.

The 1395 kg of lesser spotted dogfish caught on the survey was the fourth most abundant species by catch weight, which is a similar ranking to that seen for the species in 2020 (third). As with spurdog, the distribution of the lesser spotted dogfish was found to be more concentrated in strata 3 & 4 (figure 6d). While most of the specimens recorded in 2020 were over 50 cm, in 2023 only 35% (n = 726 out of 2030, figure 7d) were in this size range.

A total of 22 common skate were caught during the survey; five flapper skate (four males, 68 – 120 cm, 22.26 kg, and one female, 124 cm, 12.08 kg) and 17 blue skate (nine males, 49 – 123 cm, 44.62 kg, and eight females, 32 – 121 cm, 48.65 kg). Of note was that 17 of these were caught at just four stations in Stratum 1; NW14, NW16, NW15 and NW11. Unfortunately, only one individual was deemed lively enough to tag (104 cm female blue skate, 7.9 kg at NW11).

## Other Ichthyological Observations

102 fish species were recorded on the survey. The smallest was an *Alloteothis subulata* at 2 cm caught at BC2, while the largest was a 137 cm male tope at NW15. Other species of note were a tadpole fish *Raniceps raninus*, a juvenile red band fish and juvenile examples of conger eel, including a post-larval stage.

### *d} Distribution of macrobenthos, gelatinous zooplankton and anthropogenic debris*

Table 5: Macrobenthos on the survey, ranked by descending number of stations upon which they were observed

Common name	Scientific Name	Cefas code	No. of stations
Pink shrimp	<i>Pandalus montagui</i>	PRM	18
Sand star	<i>Astropecten irregularis</i>	API	16
Common sea mouse	<i>Aphrodite aculeata</i>	AAC	15
Common swimming crab	<i>Polybius holsatus</i>	LMH	15
Dead-man's fingers	<i>Alcyonium digitatum</i>	DMF	14
Common starfish	<i>Asterias rubens</i>	STH	13
Hermit in whelk	<i>Eupagurus bernhardus</i>	HIW	13
Opisthobranch	<i>Scaphander lignarius</i>	SDL	13
Serpent star	<i>Ophiura ophiura</i>	OHT	13
Hermit in <i>Adamsia</i>	<i>Pagurus prideaux in Adamsia</i>	HIA	12
Ghost shrimp	<i>Pasiphaea</i> spp.	PAS	11
Common whelk	<i>Buccinum undatum</i>	WHE	10
Broken shell	-	BSL	10
Green sea urchin	<i>Psammechinus miliaris</i>	PMM	10
Shrimp	<i>Processa</i> spp.	PCY	10
Rocks	-	ROK	9
Brown shrimp	<i>Crangon allmanni</i>	CGA	9
Spiny starfish	<i>Marthasterias glacialis</i>	MAG	9
Hermit crabs	<i>Pagurus</i> spp.	PAY	8
Hydroid (unidentified)	Hydroida	HYD	8
Circular crab	<i>Atelecyclus rotundatus</i>	ALR	7
Edible sea urchin	<i>Echinus esculentus</i>	URS	7
Scorpion spider crab	<i>Inachus dorsettensis</i>	IND	7
Anemone (unidentified)	-	AMU	6
Bloody henry starfish	<i>Henricia oculata</i>	HEO	6
Common prawn	<i>Palaemon serratus</i>	CPR	6
Whelk eggs	-	WES	6
Common pelican's foot	<i>Aporrhais pespelicani</i>	APP	5
Common brown shrimp	<i>Crangon crangon</i>	CSH	4
Dahlia anemone	<i>Urticina felina</i>	DHA	4



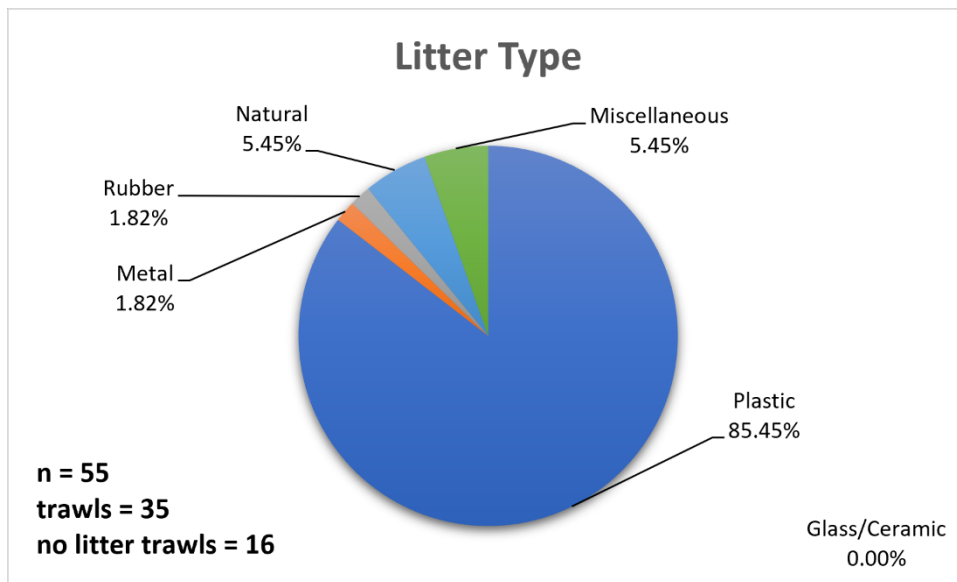
Marine leech	<i>Pontobdella muricata</i>	PDM	4
Common cockle	<i>Cerastoderma edule</i>	COC	3
Parchment worm tubes	<i>Chaetopterus spp.</i>	CVT	3
Red cushion star	<i>Porania pulvillus</i>	PPV	3
Ross worm colonies	<i>Sabellaria spinulosa</i>	RCL	3
Squat lobster	<i>Munida rugosa</i>	MNR	3
Swimming crab	<i>Macropipus tuberculatus</i>	MPT	3
Anemone	<i>Actinauge richardi</i>	ACR	2
Breadcrumb sponge	<i>Halichondria panicea</i>	BCS	2
Couch's crab	<i>Monodaeus couchi</i>	EPM	2
Cushion star	<i>Asterina gibbosa</i>	ATG	2
Dog cockle	<i>Glycymeris glycymeris</i>	GLG	2
Friendly bladed shrimp	<i>Spirontocaris lilljeborgii</i>	SPL	2
Graceful sea snail	<i>Colus gracilis</i>	CSG	2
Humphrey's whelk (TBC)	<i>Buccinum humpreysianum</i>	WHH	2
Norway cockle	<i>Laevicardium crassum</i>	LCC	2
Plumose anemone	<i>Metridium senile</i>	PMA	2
Sea lemon	<i>Archidoris pseudoargus</i>	ADP	2
Slender-leg spider crab	<i>Inachus leptochirus</i>	INL	2
Swimming crab	<i>Liocarcinus depurator</i>	LMD	2
Tubularia hydroids	<i>Tubularia spp.</i>	TUI	2
-	<i>Pontophilus spinosus</i>	PPS	1
Anemone spp.	<i>Bolocera tuediae</i>	BCT	1
Anemone with pagurus	<i>Calliactis parasitica</i>	CAR	1
Angular crab	<i>Goneplax rhomboides</i>	GOR	1
Banded carpet-shell	<i>Paphia rhomboides</i>	TVR	1
Cloak anemone	<i>Adamsia palliata.</i>	AMP	1
Common sunstar	<i>Crossaster papposus</i>	CTP	1
Curly weed	<i>Alcyonidium diaphanum</i>	ALG	1
Dark necklace shell	<i>Euspira fusca</i>	EFU	1
Devonshire cup-coral	<i>Caryophyllia smithii</i>	DCC	1
Elegant sea anemone	<i>Sagartia spp.</i>	SAG	1
Epizoanthid	<i>Epizoanthus spp.</i>	EZI	1
Feather stars	<i>Crinoidea spp.</i>	CNZ	1
Gibbs spider crab	<i>Pisa armata</i>	PAA	1
Granulated topshell	<i>Calliostoma granulatum</i>	PTQ	1
Hermit crab	<i>Anapagurus laevis</i>	APL	1
Hermit crab in unidentified topshell	<i>Anapagurus spp.</i>	HIE	1
Hermit in <i>Suberites</i>	<i>Pagurus spp. in Suberites</i>	HIS	1
Hornwrack	<i>Flustra foliacea</i>	FAF	1
Horse mussels	<i>Modiolus spp.</i>	MOD	1

Krill	<i>Euphausia spp.</i>	KRX	1
Leach's spider crab	<i>Inachus phalangium</i>	INP	1
Long-leg spider crab	<i>Macropodia rostrata</i>	MCR	1
Macropodias	<i>Macropodia spp.</i>	MCX	1
Mantis shrimp	<i>Rissoides desmaresti</i>	MED	1
Marbled swimming crab	<i>Liocarcinus marmoreus</i>	LMM	1
Necklace shells	<i>Euspira (polinices)</i>	PNC	1
Ocean quahog	<i>Artica islandica</i>	CLQ	1
Painted topshell	<i>Calliostoma zizyphinium</i>	PTS	1
Pandalid shrimp	<i>Pandalidae</i>	PSH	1
Poraniomorpha cushion stars	<i>Poraniomorpha spp.</i>	PMH	1
Purple heart urchin	<i>Spatangus purpureus</i>	SPG	1
Ray/skate eggcase	-	RES	1
Red snapping shrimp	<i>Alpheus glaber</i>	ALP	1
Red whelk	<i>Neptunea antiqua</i>	RWK	1
Sars' starfish	<i>Luidia sarsi</i>	LUS	1
Sea firs	<i>Nemertesia spp.</i>	NEM	1
Sea potato	<i>Echinocardium cordatum</i>	ECC	1
Sea potatoes	<i>Echinocardium spp.</i>	ECV	1
Sea squirts	Ascidiacea	SSX	1
Sea urchin	<i>Echinus acutus</i>	URA	1
Seven-armed starfish	<i>Luidia ciliaris</i>	LDC	1
Slender spider crab	<i>Macropodia tenuirostris</i>	MCT	1
Sponges	Porifera	PFZ	1
Squat lobster	<i>Galathea spp.</i>	GLX	1
Topshells	<i>Gibbula spp.</i>	GTX	1
Whip shrimp	<i>Dichelopandalus bonnieri</i>	PDB	1

As can be seen by Table 5, 95 species of macrobenthos were recorded on the survey, with examples seen at every location sampled. A total of 78.6 kg was caught. The pink shrimp *Pandalus montagui*, was the most widely distributed species seen, being noted at 18 of the 30 stations fished. Of note was the mantis shrimp *Rissoides desmaresti*, which was caught at BC13.

Only two species of jellyfish were recorded on the survey. A total of 45 barrel jellyfish *Rhizostoma octopus* were weighed and measured (8.5 – 49.5 cm, 90.2 kg), 25 of which were caught at BC4. The other species seen was the blue jellyfish *Cyanea lamarckii*, which were weighed only; 0.032 kg was caught at NW19.

As can be seen in Figure 8, there were 55 litter items logged, totalling 4.6 kg in weight. Of those 55 items, 47 were plastic, over 85% of all litter collected. Out of the 35 stations/trawls (both valid, invalid and additional), 16 had no litter items recorded, meaning this litter was collected over 19 stations, averaging 2.9 items per tow. Plastic was the most numerous type of litter observed, making up 85% of the total number of individual pieces caught.



**Figure 8:** summary of the marine litter collected on the survey by type

*e) Surface and bottom temperature and salinity data using CTD.*

A SAIV CTD unit was attached to the trawl and recorded temperature and salinity data for 32 of the 35 tows. The unit was unavailable for three tows at B10, CD4 and NW11. In addition, profiles including temperature and salinity were also taken by EMS2 profiler at 15 locations (Table 2), and a further three surface water samples at BC13, BC14 and BC16 before the hydro winch was repaired to allow bottom salinity sampling.

*2. To collect multibeam data and fisheries acoustic data at three operating frequencies (38, 120 & 200 kHz) continuously throughout the survey.*

The newly installed EK80 echosounder allowed the collection of acoustic data throughout the survey on five frequencies (38, 70, 120, 200 and 333 kHz).

*3. Tag and release specimens... in support of the ICES Working Group for Elasmobranch Fishes work to inform on stock units for demersal elasmobranchs.*

A total of 101 elasmobranchs were tagged and released during the survey using Petersen tags following Cefas welfare protocols. Spurdog was the most abundant species tagged, with 60 individuals recorded. Other species tagged included starry smooth hound (25), the greater-spotted dogfish *Scyliorhinus stellaris* (10), tope (4) and a spotted ray and blue skate (1).

4. *To freeze any unusual fish species for subsequent identification / verification in the laboratory, including... any unusual fish species, which may also be used in otolith research.*

Six examples of macrobenthos were retained for subsequent identification and clarification, including Couch's crab *Monodaeus couchi* and the shrimp *Processa spp.* Examples of a reticulated dragonet *Callionymus reticulatus*, greater sandeel *Hyperoplus lanceolatus* and juvenile conger eel were also retained.

5. *To retain any dead specimens of tope *Galeorhinus galeus* and common blue skate *Dipturus batis* and flapper skate *D. intermedius* for biological studies (Jim Ellis).*

A male and female tope that had perished in the net at CD1 were frozen and retained for further analysis after the survey. At BC5, a male and female blue skate were also found dead upon capture and retained.

6. *Collect additional data from dead skates and rays...*

A total of 41 elasmobranchs that were found dead upon capture were analysed for additional information and had their vertebrae removed and retained. This was completed for six species; blonde ray (13), spotted ray (11), small-eyed ray *Raja microocellata* (8), thornback ray (5), cuckoo ray (3) and a blue skate (1). In addition, the protocols for collecting this data were reviewed for subsequent surveys.

7. *Retain any dead specimens of shad and lamprey for biological studies.*

One twaite shad *Alosa fallax* was found dead upon capture at BC16 and was retained for analysis after the survey.

8. *Cetacean observations will be recorded where possible and sent to the Sea Watch Foundation.*

Only one observation of common dolphin *Delphinus delphis* was recorded on the survey, with that information sent to Sea Watch Foundation and MarineLife.

9. *Collect, retain, and filter surface water samples from Ferrybox underway water supply...*

With sampling not required until March, chlorophyll filtration samples were not collected until the survey resumed on March 4. Between then and the end of the survey, seven samples were collected.

10. *Collect queen scallops (queenies) *Aequipecten opercularis* to allow for experimental work...*

A sample of queen scallops was retained from the catch at BC7 for further analysis after the survey.

11. Genomic sampling of particular fish species to improve the methodology to assess finfish, pelagic, data-limited, and non-quota UK priority stocks.

**Table 6:** Summary of genomic sampling conducted on the survey

Common species name	Scientific species name	No. sampled	Length range (cm)	Weight range (g)
Herring	<i>Clupea harengus</i>	16	11.5–27.0	8–113
Horse mackerel	<i>Trachurus trachurus</i>	72	8.5–41.5	6.7–545
Sprat	<i>Sprattus sprattus</i>	16	5.5–12.5	1–14.6
Plaice	<i>Pleuronectes platessa</i>	24	14–37	22–546
Dover sole	<i>Solea solea</i>	11	13–21	16–85

As can be seen in Table 6, 139 individual fish were sampled for genetic material, with all five selected species sampled. With horse mackerel as the most abundant of these species caught, consequently they were most sampled by this work. The low numbers of Dover sole *Solea solea* sampled were the result of only 92 individuals caught on the survey in total and priority given to the primary survey aim.

In addition to the sample collection, procedures for the sampling were reviewed and refined for use on subsequent surveys.

12. Retain examples of mackerel *Scomber scombrus* for sampling training on shore.

A selection of mackerel which satisfied size and number requirements were retained from the catch at EG1.

## ACKNOWLEDGEMENTS

The survey team would like to acknowledge the outstanding work by the officers and crew of RV Cefas Endeavour, both in trialling a new survey gear and the accompanying issues with such work, but also with the mindset of maintaining safety as the number one priority on board. In addition, the efforts by Brian Salter and the rest of the AWSM management team in securing the delivery of the new trawl before the survey and all required accompanying gear, as well as Rob Kynoch's time spent helping to rig and attune the net for RV Cefas Endeavour was much appreciated.

Ben Hatton and Louse Straker Cox  
Scientists in Charge  
21/03/2023

DISTRIBUTION:

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Jim Ellis and Sally Songer – Directors of Cefas Fisheries International Centre of Excellence;  
Gary Burt – Data steward  
Cefas fisheries SICs/2ICs  
Daniel Evans - AWSM Head of Operations and Technical  
FCO – for Republic of Ireland  
IFCAs  
Welsh Government  
MMO  
BODC



## Appendix I: Net geometrics for JTS610 light hopper trawl

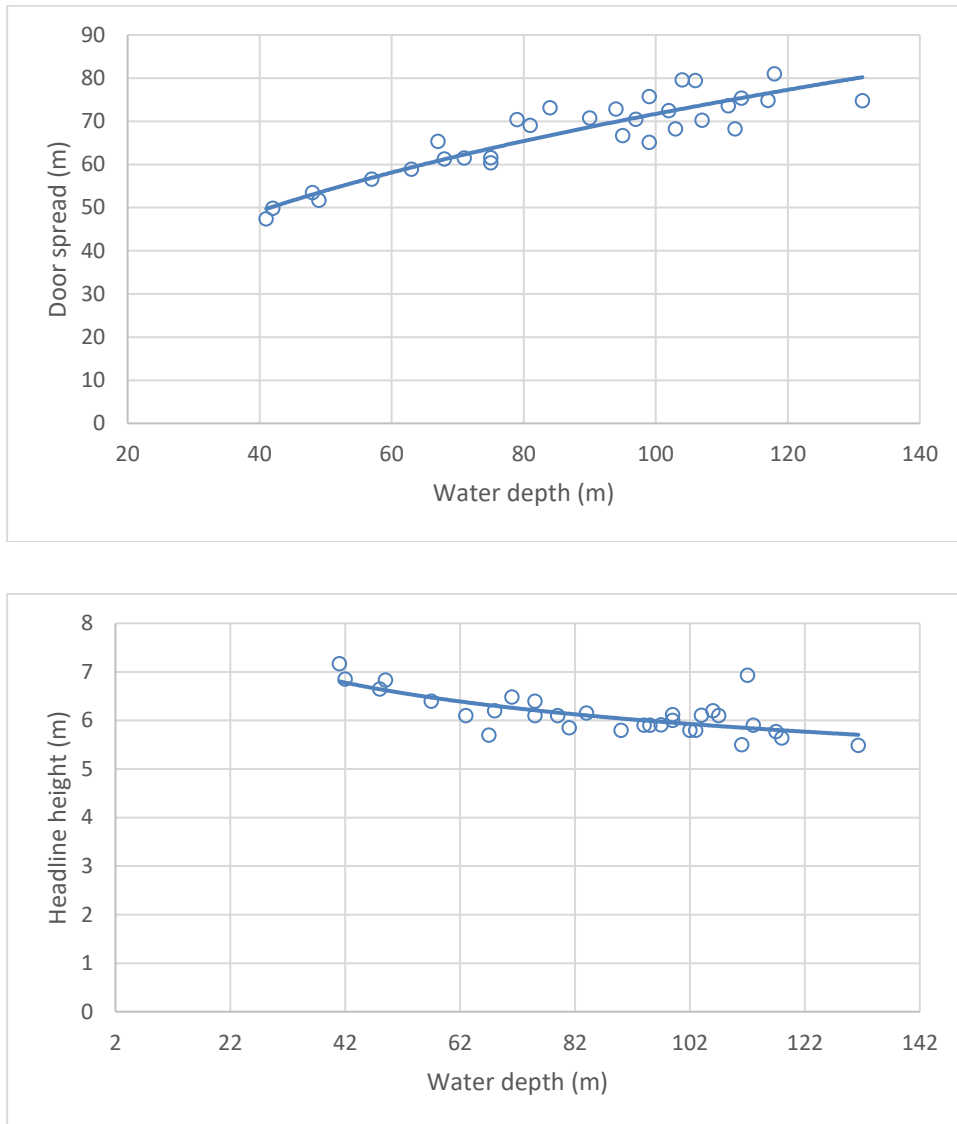


Figure 9: Geometrics for door spread (top) and headline height (bottom) by water depth

## Appendix II: Summary of survey stations completed

Station Name	Stratum No.	Priority	Completed (y/n)	Comment
NW11	1	Secondary	Y	
NW12	1	Secondary	Y	
NW14	1	Primary	Y	
NW15	1	Secondary	Y	
NW16	1	Primary	Y	
NW19	1	Primary	Y	
SW2	2	Secondary	N	
SW3	2	Secondary	N	
SW4	2	Secondary	N	
SW5	2	Secondary	N	
SW7	2	Secondary	N	
SW9	2	Primary	N	Lost time to poor weather
SW14	2	Secondary	N	
SW15	2	Secondary	N	
SW17	2	Primary	N	Lost time to poor weather
BC1	3	Primary	Y	
BC2	3	Primary	Y	
BC3	3	Primary	Y	
BC4	3	Primary	Y	
BC5	3	Primary	Y	
BC6	3	Primary	Y	
BC7	3	Primary	Y	
BC8	3	Primary	Y	
BC9	3	Primary	Y	
BC10	3	Primary	Y	
BC11	3	Primary	Y	
BC12	3	Primary	Y	
BC13	3	Primary	Y	
BC14	3	Primary	Y	
BC15	3	Primary	Y	
BC16	3	Primary	Y	
BC17	3	Primary	Y	
BC18	3	Primary	N	No fishable ground
CD1	4	Primary	Y	
CD2	4	Primary	Y	
CD3	4	Primary	Y	
CD4	4	Primary	Y	
IS1	5	Primary	Y	
IS2	5	Primary	N	Lost time to poor weather
IS3	5	Primary	N	Lost time to poor weather
IS4	5	Primary	Y	
IS5	5	Primary	Y	
IS6	5	Primary	Y	
IS7	5	Primary	N	No fishable ground
EG1	6	Primary	Y	Net drum testing tow
EG2	6	Primary	N	Abandoned due to lost time
EG3	6	Primary	N	Abandoned due to lost time
EG4	6	Primary	N	Abandoned due to lost time
EG5	6	Primary	N	Abandoned due to lost time



LB1	7	Primary	N	Abandoned due to lost time
LB2	7	Primary	N	Abandoned due to lost time
LB3	7	Primary	N	Abandoned due to lost time
LB4	7	Primary	N	Abandoned due to lost time
LB5	7	Primary	N	Abandoned due to lost time
LB6	7	Primary	N	Abandoned due to lost time
LB7	7	Primary	N	Abandoned due to lost time
MC1	8	Primary	N	Abandoned due to lost time
MC2	8	Primary	N	Abandoned due to lost time
MC3	8	Primary	N	Abandoned due to lost time
MC4	8	Primary	N	Abandoned due to lost time
MC5	8	Primary	N	Abandoned due to lost time
MC6	8	Primary	N	Abandoned due to lost time
CI3	9	Secondary	N	
CI7	9	Secondary	N	
BY2	10	Primary	N	Abandoned due to lost time
BY4	10	Primary	N	Abandoned due to lost time
BY7	10	Primary	N	Abandoned due to lost time